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The Principles and Practice of Pasteurizing.

The numerous inquiries now being received in regard to the practice of, and appliances needed for, Pasteurizing of wines render it expedient to put in print, for general information, the main points in the premises.

The essential point to Pasteurizing is to heat wine to the temperature of 150°, or thereabouts, out of contact with air. This heating should be done as quickly as possible, and after the proper temperature has been reached it is best, other things being equal, to cool the wine as quickly as possible.

Several objects are accomplished by this heating. The one most generally aimed at is to kill the germs of all kinds of fermentation that may exist in the wine, in order that it may be safe from farther changes under their influence. Another is to advance the wine toward maturity. Also, to forestall any farther deposition of sediment, by the coagulation of the albuminous matters it still contains, and which endanger its soundness.

The general plan in the construction of Pasteurizers is usually the same as that of the various kinds of still condensers; only, in this case the water around the worm is hot, and the cold wine in passing through the worm is heated to the proper point by allowing it to move with greater or less rapidity, in a solid column, so that a thermometer inserted at the exit end will show steadily the desired temperature. Beyond the thermometer, the wine passes into a cooler, from which it is delivered into the (well-cleaned) storage or shipping packages. In many cases, it is delivered into these directly from the Pasteurizer, and allowed to cool in the tightly bunged casks.

Wines of sufficient age, that have ceased to deposit sediment and are bottle-ripe, may be pasteurized in the bottles themselves, in a water-bath having the proper temperature. This is the preferred practice in the case of high-class wines.

The temperature must be carefully guarded, since if it either rises too high, or continues too long even at its proper point, the wine may acquire a "cooked" taste, and may lose its natural bouquet. Immediately after the operation the wine is somewhat flat, but in the course of a few weeks not only fully recovers its zest, but is found very much advanced toward maturity.

The Rationale of Pasteurization.—The effects of this process upon the wine may be thus summarized:

1. All fermentative germs of whatever nature are killed by the heat; the more promptly, the higher the heat and the alcoholic contents of the wine. Wines poor in alcohol, and especially those containing a remnant of sugar, require a higher temperature than those fully fermented out, and rich in alcohol.

2. Acids present in the wine are under the influence of the heating, partly neutralized by entering into combinations (ether-), which form part of the flavors of older wines. Hence, acetified wines become of milder taste at once, and even milksour ones gradually lose their "scratchiness," if not too far gone.

3. Wines while maturing in the cask are always found more or less impregnated with atmospheric air (oxygen), the gradual absorption of which forms a most essential part of the maturing process. After pasteurizing, the wine is found free from oxygen, proving that it has been absorbed during the process, thus often accomplishing in a short space of time an advance toward maturity that at the ordinary temperatures would have required months.

4. When the heat is raised sufficiently high (to about 160°, which can be done without injury to most classes of wine), the unstable "albuminoid," substances of new wines that continue to cause the formation of deposits of lees, for one or even two years after the completion of the vinous fermentation, are at once rendered insoluble and thereafter cease to give trouble; the wine, after having been cleared by settling or filtration, forms no more deposits, and can, if necessary, be bottled.

It should be understood that while pasteurization puts an end to all further fermentation, it does not interfere in the least with the ordinary process of maturing in the cask. But, save in cases of emergency, it must not be practiced before the completion of the after-fermentation.

Should a wine, however, be found to be "going wrong" while the after-fermentation is progressing, it may be pasteurized to stop farther damage, and will then be ready to be started on a healthy after-fermentation the following season, or sooner if the materials (*e. g.*, condensed must) are at hand.

Pasteurization thus stands in lieu of any and all antiseptics heretofore used in the wine itself; it should replace sulphuring no less than salicylic acid. Of course, sulphuring will always be eminently useful in the cleansing or disinfection of caskage, and remains indispensable in clearing the cellar of foul germs.

Precautions Necessary to Insure Success.—While a well-pasteurized wine is secure against farther action of the ferment germs previously contained in it, it is, like any other wine, sub-

ject to re-infection from foul packages, bungs, pumps, hose, etc., as well as from impure water and air. Impure water used in rinsing packages is a fruitful source of trouble, and the bottling of wine in close, musty, unventilated and unsulphured cellars is responsible for many bottles of damaged wine, especially if the corks used have not been scalded in hot water. From want of these reasonable precautions, it has often been reported that pasteurizing is not the universal cure for wine diseases that, with proper care, it has always proved to be. Just as a dose of quinine cannot permanently prevent the denizens of malarious valleys from contracting chills and fever, so Pasteur's admirable process does not secure wine against injury from carelessness and filth.

The Practice of Pasteurizing.—Among a score of varied appliances brought forward by different inventors, a few only have gained wide acceptance. For California practice the "intermittent" patterns will hardly be considered; of those intended for continuous operation, which alone are adapted for large-scale practice, there are essentially two types. In one (including the "oenotherms" of Terrel des Chenes and of Carpené) the cold wine passes through one or several metallic (block tin, or copper tinned) pipes immersed in water heated by proper furnaces, or by steam; in the other, the pipes are replaced by a ring-shaped space between an inner and outer cylinder. The former system has on the whole been more generally accepted.

As has been stated above, the overheating of any portion of the wine must be carefully avoided. Hence the temperature of the water-bath must not greatly exceed that desired for the wine, since otherwise the outside portions would, in traversing the pipe, be heated up too high and therefore be "cooked" (the same objection lies against heating the wine in a closed tank by means of a steam coil, as has sometimes been done). Hence again, large pipes are unsuitable, as the temperature would be taken too slowly, and as a single small pipe would reduce too much the working capacity of the apparatus, the inlet pipe is made to branch into a number of these, disposed in the form of either a ribbon, or a loose bundle, of coils. In Terrel's apparatus (which may be considered the most perfect) the cooler is similarly arranged.

For ordinary purposes, however, this complex and somewhat costly construction is very commonly replaced by a single pipe forming a long coil of somewhat greater diameter than those in Terrel's apparatus; and this form, being easily constructed by any plumber, is sufficiently well adapted to the needs of small producers.

At the winery of Mr. Juan Gallegos, near Mission San Jose, a Pasteurizer of satisfactory working and output consists of a 90 gallon "farm boiler," within which is placed a coil consisting of 130 feet of $\frac{3}{4}$ -inch block-tin pipe, held in form and position by four straps (U-cross section) of strong galvanized sheet iron, to which the coils are soldered, so that the whole can be freely handled and taken out of

the boiler when not in use. A similar coil in a wooden tank forms the cooler, and the capacity of the apparatus is about 450 gallons per day (ten hours).

The Pasteurizer in use at the viticultural laboratory of the University has a coil of $\frac{3}{4}$ -inch block tin pipe, 30 feet long, immersed in a 15-gallon boiler; a 20-foot coil of the same pipe forms the cooler. The capacity of this single pipe is 8 to 10 gallons per hour when the tank water is kept at about 160°; with ten similar tubes and a bath temperature of 170° (which is admissible for many wines) in a 100-gallon boiler, the hourly capacity would be over 100 gallons, or say 1000 gallons in ten hours.

A large apparatus according to Terrel, with a capacity of 250 gallons per hour, costs at the factory \$240.

In order that any of these appliances may work with perfect regularity, it is best that the wine should descend by gravity from a supply cask, adjusted once for all to such a height above the heater as to form a proper pressure column; into this supply cask the wine to be treated is pumped as needed. Pumping the wine directly into the heater is objectionable because of the spasmodic action, by which some portions of the wine may escape adequate heating, while others are overheated. For the regulation of the flow to the exact temperature desired, a faucet (tinned inside) is interposed between the cask and the heater; it is convenient to have another placed between the heater and the cooler, or the receiving cask. The inlet pipe must descend to the bottom of the heater, so that the wine moves *upward* in the spiral; otherwise accumulation of gas bubbles causes irregularities. When a cooler is used, fuel may be saved by using it, instead of water, the wine that is to be heated and may thus be given a part of its increase of temperature.

It will thus be seen that pasteurizing is an exceedingly simple operation, which can be performed by any intelligent laborer who can read a thermometer and adjust a faucet.

Utility of Pasteurization.—When it is considered to how great an extent the general use of the pasteurizing process can do away with the most serious difficulties under which California winemakers labor, its importance can hardly be overestimated. Our hot vintage season and the imperfect methods of fermentation still so commonly practiced, render our wines peculiarly liable to the introduction of noxious germs, which develop so soon as the after fermentation is completed, if not sooner. Pasteurizing will put a final stop to these dangers, provided proper care and cleanliness is used in handling them afterward.

It is the common practice to ship our wines when very young, and they go to long distances and pass through great alternations of temperature. Once pasteurized, they will stand this treatment without material danger or deterioration. If given rest for some weeks after the process, they may be fined, if necessary, and will arrive nearly as clear as they left the shipper.

One of the most serious sources of complaint against California wines in the East is that they "will not keep," the cause being very generally the fact that, being too young to be bottled like imported wines of greater age, they undergo unsound fermentation in the bottles, as they still contain germ food, and possibly germs of all kinds. All this is done away with by pasteurizing, without the need of salicylic acid and without injury to the wine.

I believe that when these matters are fully understood by our winemakers and shippers, the Pasteurizing of wines before shipment will become the rule instead of the exception. A prudent shipper dealing with valuable wines, of the perfect soundness of which he has the slightest doubt, will not jeopardize his pecuniary interest and his reputation by omitting so

simple and inexpensive a means of insuring their perfect safety. Wines made with all proper precautions may still go, unscathed, as they come from the storage casks, but even the additional "age" imparted by Pasteur's process will, when wines are properly graded and valued, generally pay for the labor involved.

But all inducement toward the improvement of our product vanishes so long as the wine-dealer continues to preach and act upon the maxim that "wine is wine" in his dealings with the producer. The communistic principle is fatal to all individual improvement and progress, whether applied to society or to wine production; it stands next to adulteration and stretching in barring the progress of the wine industry in California.

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